



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

|   |           |  |
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| (51) International Patent Classification <sup>6</sup> :<br><b>H04Q 7/32, 7/38</b> | <b>A1</b> | (11) International Publication Number: <b>WO 97/40638</b><br>(43) International Publication Date: 30 October 1997 (30.10.97) |
|---|-----------|--|

(21) International Application Number: PCT/SE97/00389

(22) International Filing Date: 7 March 1997 (07.03.97)

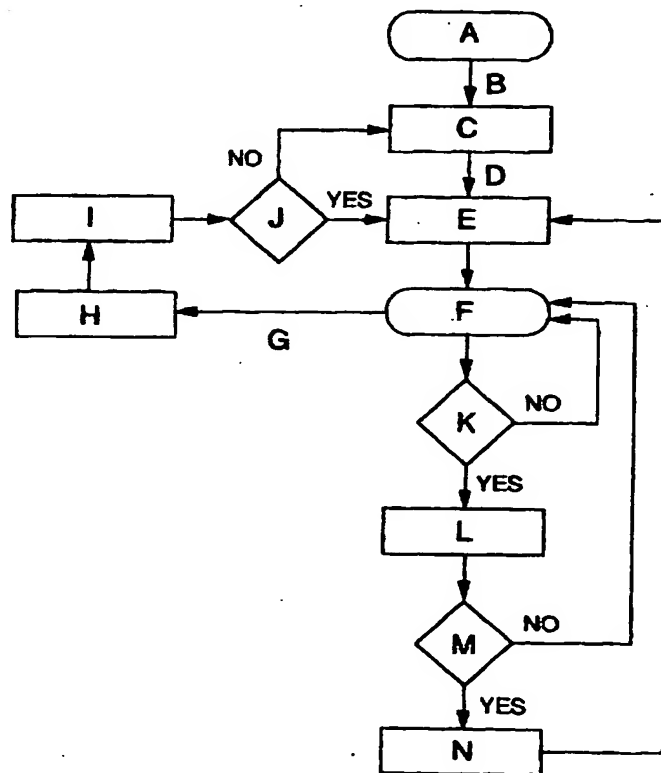
(30) Priority Data:  
9601559-9 24 April 1996 (24.04.96) SE(71) Applicant (for all designated States except US): TELIA AB  
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Rudsjöterrassen 2, S-136 80 Haninge (SE).(81) Designated States: NO, US, European patent (AT, BE, CH,  
DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT,  
SE).**Published***With international search report.**Before the expiration of the time limit for amending the  
claims and to be republished in the event of the receipt of  
amendments.*(54) Title: METHOD AND DEVICE AT A MULTISUBSCRIPTION TERMINAL FOR SELECTING AN ACCESS NETWORK IN A  
MULTINETWORK ENVIRONMENT

## (57) Abstract

The invention relates to a device and a method at a digital mobile telecommunications system and/or datacommunications system which allows, at utilization of multi-subscription terminals, access to different in the system included networks depending on the order of priority of the subscriptions of the terminal. The invention is briefly characterized in one in the telecommunications terminal cooperating device which includes means for network selection which describes how the terminal shall act when it has possibility to lock itself to a multiple of different access networks. Further, the device includes a number of possible priority lists which indicates the order of priority of the subscriptions of the terminal or identities and where the user or the operator himself/herself indicates his/her preferences.



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**METHOD AND DEVICE AT A MULTISUBSCRIPTION TERMINAL FOR SELECTING AN ACCESS NETWORK IN A MULTINETWORK ENVIRONMENT****5 TECHNICAL FIELD**

The present invention relates to a device and a method at a multisubscription terminal in a digital mobile telecommunications system or data communications system for use in multinetwork environments.

10

**PRIOR ART**

Wireless terminals based on the DECT-standard and its Generic Access Profile (GAP) are made possible to use in a number of different environments together with base stations and radio switches which have been connected to different public or private networks. To make it possible to use the terminal to a certain fixed radio equipment is required that the terminal has the access right key (PARK) which is required to be used to the system in question. A terminal can have a multiple of identities (IPUI), and each identity can be connected to a multiple of access right keys. A pair of a portable identity and an access right key is here called a subscription. Based on a subscription, the terminal can make access to only one network, whereas access to a multiple of networks can be made, based on the same IPUI. This is different from corresponding GSM-case where there is only one identity in the terminal (on the SIM-card) based on which the GSM-terminal can make access to a multiple of networks.

A terminal with a multiple of subscriptions can be used to a multiple of access networks, but there is nowhere described how it shall act when it is within coverage from a multiple of access networks at the same time. Both the user of the terminal and operators consequently should be interested in that there is possibility to control how the

terminal shall select network in situations when there are a multiple of different access networks to which the terminal can lock itself. It can, for instance, be desirable that a wireless telephone, which also can be used outdoors to a public coverage in the first place shall lock itself to the home base it belongs to, even if the received signal strength from the public base station is higher than the received signal strength from the homebase.

The problem the invention intends to solve, consequently is to produce a device and method which makes it possible to control how the terminal shall select network in situations when there are a multiple of different access networks within the coverage to which the terminal can lock itself.

Examples of multisubscription terminals which must be able to manage this described problem are:

- DECT GAP-terminals. A DECT-terminal based on DECT's Generic Access Profile is made to be used to different networks and also shall be able to manage a multiple of identities. For instance a private subscription to home base and a public subscription for a "telecommunication zone"-like service.

- DECT/GSM IWP-terminal which uses DECT/GSM Interworking Profile to utilize GSM-services over DECT's radio route. This terminal has GSM-subscription on SIM-cards or DAM-cards with GSM-application. Because DECT/GSM IWP is based on GAP, the terminal also shall be possible to use to DECT GAP-system and consequently is faced with the same problem as the DECT GAP-terminal. The GSM-subscription is here handled in the same way as the "GAP-subscriptions" by means of special values of IPUI and PARK.

- Combination terminals DECT+GSM. A combination terminal is a terminal consisting of a GSM-terminal and a DECT-terminal with shell and user-interface in common. The DECT-part shall have the same functionality as a DECT/GSM IWP-terminal. The combination terminal can in an automatic mode

change between working as a DECT-terminal depending on accessible networks.

Yet there is no description of how coming DECT GAP-terminals will handle the above described problems with selection of networks. There are indications from manufacturers that they want opinions about how the terminals shall act.

The first delivered combination terminal can in one mode automatically select between working as a GSM-terminal or a DECT-terminal. This choice is not based on subscription in the terminal and cannot be generalized to personal priority lists in multinetwork environments.

A GSM-telephone has a similar algorithm for selection of operator abroad. This is based on only one subscription and its use in different networks. Because the GSM-network aims at being completely covering, selection of networks however does not occur very often, and the GSM-algorithm is not sufficiently detailed and flexible to solve the problem which is treated in this patent application. Possibly there are more detailed algorithms for use in multiband-terminals GSM/DCS 1800, but also these are probably based on one subscription.

#### SUMMARY OF THE INVENTION

The aim with the present invention consequently is to solve above mentioned problems and implement the technical solution in the described terminals.

This aim is achieved with one in the telecommunication terminal co-operative device and a method which is characterized in that it includes:

a network selection algorithm which describes how a multisubscription terminal shall act when it has possibility to lock itself to a multiple of access networks;

a number of possible priority lists which indicate the order of priority of the subscription of the terminal, or

identities connected to said access network, at which the user or the operator himself/herself can indicate his/her priority preferences;

means to listen for or identify a multiple of different access networks, and at the same time evaluate them with regard to signal quality and priority.

Further characteristics of the present invention is given below in the independent patent claims.

10 BRIEF DESCRIPTION OF THE DRAWING

In the following is given a detailed embodiment of the invention with reference to the only figure which shows a flow chart of the network algorithm which is utilized by the device in the multisubscription terminal.

15

A = Off

B = Power Switched on

C = Evaluate

D = Select new channel

20 E = Attach

F = Registered

G = Losing coverage

H = Detach (2)

I = Wait (2)

25 J = New network accessible ?

K = New network with higher priority ?

L = Wait (1)

M = High priority network still accessible ?

N = Detach (1)

30

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

The invention consists of :

- A network selection algorithm which describes how a multisubscription terminal shall act when it has possibility

35 to lock to a multiple of different networks;

- a number of possible priority lists (lists which indicate the order of priority of the subscriptions of the terminal or identities) where the user (or the operator) can indicate his/her preferences.

- 5       - the possibilities of a DECT-terminal to listen for and identify a multiple of different systems at the same time, and evaluate them with regard to quality and priority.

The invention is to be regarded as an invention for DECT-terminals which can be extended to be used also for  
10 combination terminals. It is probably different functional units in the terminal that control the network selection in the DECT-terminals compared with the combination terminal. In the combination terminal the unit shall, in addition to the selection of the best network based on the  
15 subscriptions of the terminal, also control two radio transmitters/receivers.

In the following description of the invention, the DECT-terminal is used for the DECT GAP-terminal, the DECT GSM IWP-terminal and the combination terminal when it is used  
20 as a GSM-terminal.

The algorithm which describes how the terminal shall act when it has possibility to lock itself to a multiple of different access networks now will be described with reference to the only figure.

25       The values of the used parameters x and y shall be selected sufficiently small to avoid that the terminals are unaccessible too long, and sufficiently big to avoid that the terminals try to attach/detach too often when they are in the border area between two networks. Initially the  
30 values 5 seconds for x and 30 seconds for y can be regarded as reasonable.

#### From

The terminal is switched off. When the terminal is  
35 switched on, it changes to the "evaluation"-mode.

### Evaluate

The terminal scans the usable channels, identifies the different systems that are sufficiently good, and creates a list over accessible networks. A DECT-network is identified  
5 by means of the ARI (Access Rights Identifier) the system transmits. The combination terminal also tries to find accessible GSM-networks. The list over accessible networks is then evaluated by means of the active priority list. That network, out of the accessible networks, is selected  
10 which is on the top of the priority list.

### Attachment

The terminal attaches to the selected network to show that it is active. The DECT-terminal makes this by  
15 transmitting LOCATE-REQUEST, and the combination terminal makes use of GSM's location updating or IMSI attach procedures over GSM's radio interface. After this the terminal changes to the registered mode.

### Registered

This is the normal switched-on mode of the terminal. It is registered as active user in the selected network. Because it is a mobile terminal, it will continuously evaluate received signal strengths in order to secure that  
25 the best channel, or the highest prioritized channel, is used.

The terminal scans the usable channels, identifies the different systems that are received sufficiently well and creates a list over accessible networks. The list over  
30 accessible networks then is evaluated by means of the active priority list. If no network with higher priority than that in which the network already is registered is found, the terminal remains being registered in the same network. If a network with higher priority is found, the  
35 network changes to "wait"-(1)-mode.



If the terminal during the evaluation of the radio channels in the "registered"-mode finds that the signal strength from the selected network is going down below a limit, the terminal shall change to the "detach"-(2)-mode.

5

Wait (1)

In order to secure that the reception from the new network was not temporary, the terminal continues evaluating the usable channels, and if the reception from the new network with higher priority is still there after x seconds, the terminal switches to the "detach"-(1)-mode. Otherwise the terminal switches back to the "registered"-mode and remains registered in the same network as before.

15

Detach (1)

The terminal "detaches" from the network in which it was registered. The DECT-terminal makes this by transmitting DETACH, and the combination terminal makes use of GSM's IMSI "detach"-procedure over the GSM's radio interface. The terminal after that switches to "attach"-mode where it "attaches" to the new network with higher priority.

20

Detach (2)

If the terminal in the mode "registered" finds that the received signal strength is going down below a limit, the terminal shall try to "detach" in the same way as in "detach" (1), in order to after that switch to the "wait"-(2)-mode. For the DECT-terminal the limit of the received signal strength is -86 dBm, whereas it for the combination terminal is up to the GSM-part to decide when the reception is too poor.

25

30

Wait (2)

In order to secure that the loss of the reception from the old network was not temporary, the terminal continues

35

evaluating the reception from the old network, and if it is still there after x seconds, the terminal switches to the "attach"-mode where it attaches to the old network. If the reception from the old network is still lacking after the x  
5 seconds, the terminal switches to the "evaluating"-mode in order to start trying to find a new network.

After the terminal has changed network, there shall pass at least y seconds, after the change, before it for some reason tries to change back to the first network again.  
10 This in order to prevent unnecessary signalling and registration when the terminal is in the border area between two networks.

The described algorithm implies that the terminal selects the network which the user has given the highest  
15 priority as long as the quality is over minimum. An extended algorithm gives the user possibility to select between using the network which has been given the highest priority in the priority list, or use the network where the best reception quality can be obtained (the order in the  
20 priority list will come second).

In the following the priority lists are described which are utilized in the "registered"-mode in the flow chart according to the Figure.

For the lists which are used to indicate the priority of  
25 the networks the terminal can access, there are two main types: Priority lists based on the subscription of the terminal, and priority lists based on a few types of networks. The subscriptions in the terminal can be on SIM-cards (GSM) and DAM-cards (DECT) and in the hardware memory  
30 of the terminal. Also the priority lists of the terminal can be stored both on cards and in the memory of the terminal.

The most simple priority list is based on different types of networks: Private (home or company) DECT-networks,  
35 public DECT-networks and DECT/GSM-access networks (DECT access to the GSM network). These different types can be

read as access right class in the access right key. For the combination terminal there will, in addition, be GSM-access to the GSM-network. There is required a special mechanism in the combination terminal to control the priority between the DECT-part and the GSM-part. A priority list based on these four types of networks should be as default in the terminal with the order of preference:

1. Private DECT-network.
2. Public DECT-network.
- 10 3. DECT/GSM-access network.
4. GSM-network.

This order of preference gives for the operator the best utilization of the capacity in the network and, for the user, probably the most economical high quality service access.

The most advanced priority list is based on the subscriptions of the terminal and gives the user the most flexible possibility to control the selection of network of his/her terminal. A DECT-subscription is here regarded as a pair of a terminal identity (IPUI) and an access right key (PARK) and gives the user possibility to place in order of preference all networks (also different access networks at the same operator as long as they have different access right identifiers, ARI) which the terminal is allowed to be used to. A possible GSM-subscription is used in the user interface of the terminal as a DECT-subscription. In the DECT-terminal the GSM-subscription is used as a DECT-subscription with a special IPUI, whereas it in the combination terminal is required a special implementation.

As complement to these two main types, one may imagine other types of priority lists. Especially, one may imagine priority lists with different levels. One possible list may be based on the IPUIs of the terminal in the first place, and after that on the PARKs which have been connected to this IPUI. Another similar possibility is to base the priority on operators in the first place, and the of the

operator's access networks which are accessible in the second place. The operator's identity can for instance be read from PARK. The user also can be imagined to group the subscriptions in, for instance, a private role and a service role. When one of these roles is activated, the terminal changes in the first place network, based on the subscriptions connected to this role, and in the second place to networks connected to the second role.

The described invention can, as has been described, be used in at least three types of terminals. These are:

- DECT GAP-terminals. The problem is framed on basis of the possibilities which exist for terminals based on DECT GAP.
- DECT/GSM-terminal. DECT/GSM InterWorking Profile (IWP) describes how DECT-systems shall be connected to the GSM-network and how GSM-services shall be possible to be offered over DECT's radio interface. A DECT/GSM-terminal fulfils the requirements from both GAP and DECT/GSM IWP. DECT/GSM IWP is based on GAP, and the DECT/GSM-terminal is faced with the same problems as the GAP-terminal, however with the difference that it also shall be able to handle a GSM-subscription in the same way as the "GAP-subscriptions".
- DECT+GSM combination terminals. A combination terminal consists of both a DECT-terminal and a GSM-terminal with common shell and control. The combination terminal shall handle the same subscriptions as the DECT/GSM-terminal, but also be able to select between using GSM's or DECT's radio interface.

The above described is only to be regarded as an advantageous embodiment of the present invention and the scope of protection of the invention is only defined by what is indicated in the following patent claims.

## PATENT CLAIMS

1. Device at a multisubscription terminal in a digital mobile telecommunications system or data communications system for use in multinetwork environments  
5 c h a r a c t e r i z e d in that it includes:

a network selection algorithm which describes how a multisubscription terminal shall act when said terminal has possibility to lock itself to a multiple of access networks;

10 a number of possible priority lists which indicate the order of priority of the subscriptions of the terminal or identities connected to said multiple of access networks, at which the user or the operator himself/herself can indicate his/her priority preferences;

15 means to listen for and evaluate a multiple of different access networks at the same time, and evaluate them with regard to quality and priority.

2. Device according to patent claim 1,  
c h a r a c t e r i z e d in that said network selection  
20 algorithm selects the access network of said multiple of access networks which has the highest priority, as long as the signal quality in said access network exceeds a predefined threshold.

3. Device according to patent claim 1,  
25 c h a r a c t e r i z e d in that the access network out of said multiple of access networks which has the best reception quality is selected, at which said priority list comes in the second place.

4. Device according to any of the previous patent  
30 claims, c h a r a c t e r i z e d in that said priority list is based on few types of access networks, at which at the top in the priority list are private access networks, followed by public access networks, national access networks and global access networks.

35 5. Device according to patent claim 4,  
c h a r a c t e r i z e d in that if said terminal is a

DECT/GSM-terminal, the access networks are placed in order of preference in the priority list according to: Private DECT-networks; 2) Public DECT-networks; 3) DECT/GSM-networks; 4) GSM-networks.

5           6. Device according to any of the patent claims 1-3, characterized in that said priority list is based on the subscriptions of said terminal, at which each subscription is regarded as a terminal identity and an access right key, which gives the user or the operator  
10 himself/herself possibility to place in order of preference all networks to which the terminal is allowed to be used.

          7. Device according to any of the patent claims 1-3, characterized in that said priority list is based on a private role and a service role, at which, when  
15 any of these roles is activated, said terminal changes network based on the subscriptions connected to this role.

          8. Device according to any of the previous patent claims, characterized in that said subscription and said priority lists are stored on for the user or the  
20 operator unique active cards, preferably DAM-cards or SIM-cards, which cooperates with the electronics of said terminal, and/or are stored in the hardware memory of said terminal.

          9. Method at a multisubscription terminal in a  
25 digital mobile telecommunications system or data communications system for use in multinetwork environments, characterized in a network selection algorithm which on the basis of priority lists and signal quality in access networks describes how said terminal shall act when  
30 said terminal has possibility to lock itself to a multiple of access networks, at which said priority lists indicate the order of priority of the subscriptions of the terminal or identities connected to said access networks.

          10. Method according to patent claim 9,  
35 characterized in that said network selection

algorithm describes different modes for said multisubscription terminal, which modes are given by:

5 a) The *from-mode*, in which said terminal is switched off and which terminal changes to "evaluation" mode when it is switched on.

b) The *evaluation-mode*, in which said terminal scans usable channels, identifies different access networks, and creates a list over accessible networks, by which the list over accessible networks is evaluated by means of the  
10 active priority list, and that network is selected which is on the top of the priority list;

c) The *attach-mode*, in which said terminal attaches to the in the "evaluation"-mode selected network to show that it is active, at which said terminal changes to the  
15 "registered"-mode;

d) The *registered-mode*, in which said terminal is registered as active user of said selected access network, and said terminal continuously scans channels in said access network and evaluates these networks in relation to  
20 said priority list and, if no other access network with higher priority than that in which the terminal is already registered is found, the terminal remains being registered in the same network; if a network with higher priority is found, said terminal changes to the "wait"-(1)-mode; if  
25 said terminal during evaluation of the radio channels finds that the signal strength from the selected network goes below a predetermined limit, said terminal changes to "detach"-(2)-mode;

e) The *wait-(1)-mode*, in which said terminal secures  
30 that reception from new network was not temporary, and if reception from the new network with higher priority still exists after x seconds, said terminal changes to "detach"-(1)-mode; otherwise the terminal goes back to the "registered"-mode and remains registered in the same  
35 network as before;

f) The *detach-(1)-mode*, in which said terminal detaches from the old network in which it was registered, after which said terminal changes to "attach"-mode where it attaches to the new network with higher priority;

5 g) The *detach-(2)-mode*, in which said terminal in the "registered"-mode finds that the received signal strength is going down below a predetermined threshold value and detaches in the same way as in the "detach"-(1)-mode, and after that changes to the "wait"-(2)-mode;

10 h) The *wait-(2)-mode*, in which said terminal continues evaluating reception from the old network, and if this reception is still there after x seconds, the terminal changes to the "attach"-mode where it attaches to the old network; if reception from the old network is still lacking  
15 after x seconds, said terminal changes to the "evaluation"-mode in order to start trying to find a new access network.

11. Method according to patent claim 10,  
c h a r a c t e r i z e d in that, after said terminal has  
changed network, there shall pass at least y seconds, after  
20 the change, before it tries changing back to the first  
network again.

12. Method according to patent claim 11,  
c h a r a c t e r i z e d in that said time variables x  
respective y are estimated to 5 respective 30 seconds.

25



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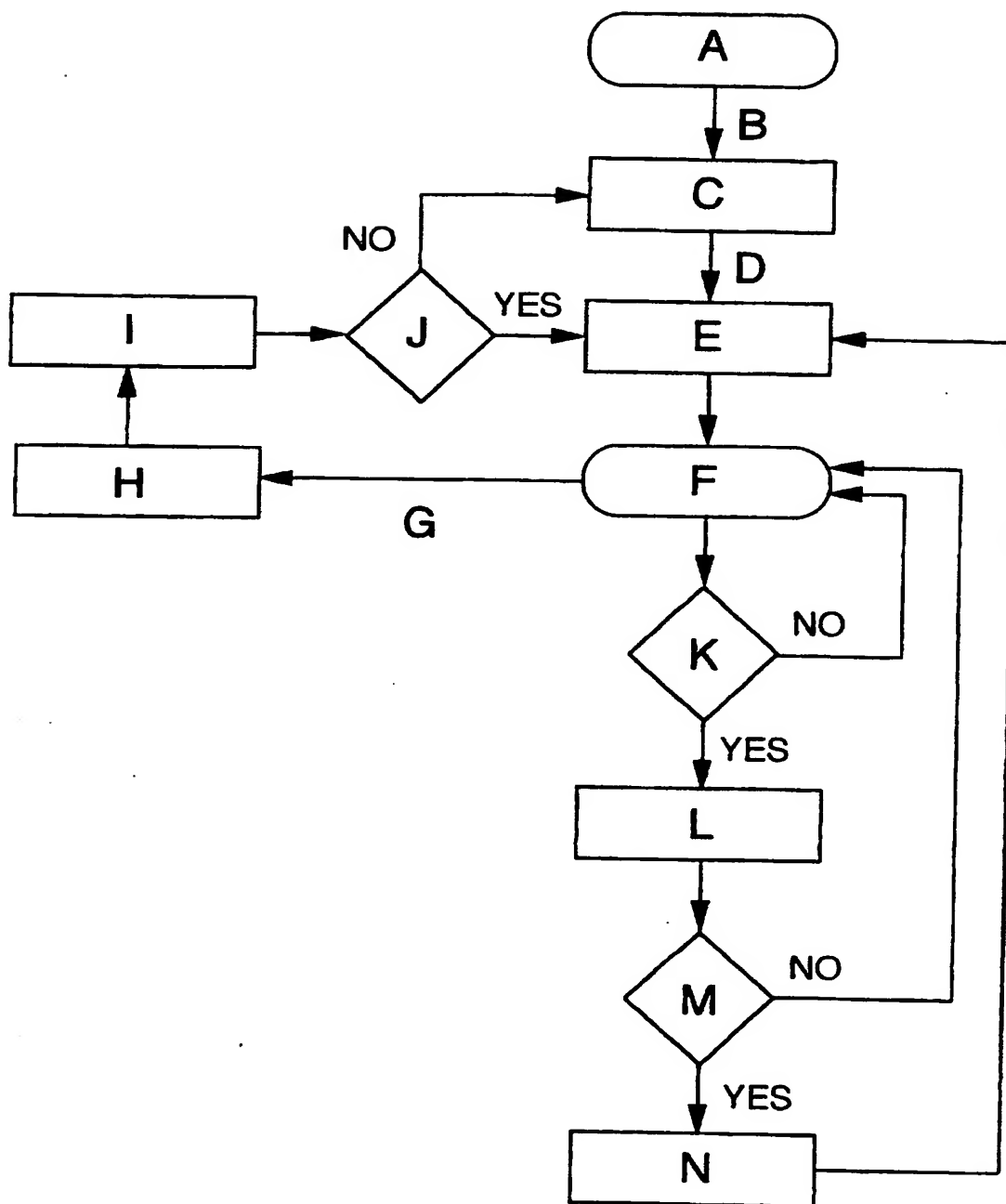


Fig. 1

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00389

## A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H04Q 7/32, H04Q 7/38

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                 | Relevant to claim No. |
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☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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International application No.

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| Patent document<br>cited in search report |         |   | Publication<br>date | Patent family<br>member(s) |             | Publication<br>date |
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